Section 912. TIMBER AND LUMBER

912.01 General Requirements. This specification covers the dimensions and engineering requirements for timber and lumber, timber piles, posts and blocks for guardrails, sign posts, mailbox posts, guard posts, guide posts, fence posts, and timber for rustic construction. Dimensional requirements, species, and wood quality shall conform to the requirements specified. When preservative treated material is specified, the chemical preservative and method of treatment shall be according to the applicable AWPA and ASTM Standards as modified herein.

Should there be a conflict between AWPA and ASTM Standards, AWPA will prevail.

All material shall be machined, including bored holes, saw cuts and kerfs, and manufactured to the final shape prior to preservative treatment. Cuts, holes, and injuries to the surface of the wood which occur after pressure treatment shall be field treated according to subsection 912.04.

The commercial and common names used for domestic hardwood and softwood timber and lumber referenced in this specification are according to ASTM D 1165.

Illustrations of how shakes, checks, splits, knots, and slope of grain are measured are given in the Glossary of Terms, subsection 912.05.

912.02 Species and Grade. All material shall be manufactured from the species specified. Material shall be graded before shipment according to grading rules in ASTM D 245. All material shall show the approved grading agency stamp indicating mill origin, species, and grade. A signed certificate of inspection covering each shipment of material shall be furnished to the Department.

912.03 Quality Control.

A. **General.** The supplier has the primary responsibility for quality control and inspection of material furnished. The treater shall be responsible for assuring that material contains the required approved grading agency stamp before treatment is commenced. The stamp or marking shall be applied as applicable, on a wide face at the trimmed end and shall be applied such that it will remain readable after treating.

B. **Inspection Prior to Preservative Treatment.** Timber and lumber shall be inspected for quality, size and straightness prior to treating, such inspections however, shall not constitute a waiver of the Department's right to later inspect and reject any material not meeting the specifications.

C. **Inspection of Preservative Treatment.** Chemical preservatives, treatment processes and treated material shall be inspected according to AWPA Standards M 2 *Standard for Inspection of Treated Timber Products* and M 3, *Standard Quality Control Procedures for Wood Preserving Plants*, and applicable associated AWPA Standards. The treater shall determine that the preservatives used conform to the requirements. The minimum frequency of the preservative analysis shall be each charge for the occasional single charge inspected. In the case of consecutive treatments from the same working tank, the first and at least one of every five additional charges, selected at random shall be analyzed.

Preservative samples shall be taken as appropriate so as to be representative of the solution used in the actual treatment process.

D. **Results of Treatment.** Results of treatment, including preservative analysis and penetration and retention determinations shall be performed according to ASTM D 1760 and associated AWPA Standards.

E. **Inspection Records.** Copies of treating records, analysis records, and other records that may be necessary to assure conformance with specifications shall be made available to Department personnel or their designated representatives upon request. Required information shall be that listed in AWPA Standard M 2. These records shall be retained by the treating plant for a minimum of five years from date of material shipment.

F. **Painting Treated Wood.** Where painting of treated wood is called for, the wood shall be air-seasoned for at least 30 days. Any preservative dust remaining on the wood shall be removed.

912.04 Field Treatment of Preservative Treated Material.

A. **General.** All cuts, saw kerfs, holes, and injuries to the surface of preservative treated material covered by this specification that occur after pressure treatment shall be field-treated by brushing, dipping, soaking, or coating. Spraying will not be permitted. The Contractor shall take care to ensure that all injuries, such as abrasions and nail and spike holes, are thoroughly saturated with the field-treating solution. Bored holes shall be poured full of preservative. Horizontal holes may be filled by pouring the preservative into the holes with a bent funnel after temporarily plugging the other end of the hole.

B. **Preservative.** The solution used for field treatment shall be a 20 percent solution of copper naphthenate, based on copper as metal, meeting the requirements of AWPA Standard P 8. The copper naphthenate shall be applied by a State of Michigan Certified Commercial Pesticide Applicator.

912.05 Terminology Used in Timber and Lumber Specifications. Refer to figure 912-1.

Annual Ring. The growth layer produced by the tree in a single growth year, including earlywood and latewood.

Bark. The layer of a tree, outside the cambian, comprising the inner bark, or thin, inner living part (phloem), and the outer bark, or corky layer, composed of dry, dead tissue.

Bird Peck. A small hole or patch of distorted grain resulting from birds pecking through the growing cells in the tree. In shape, bird peck usually resembles a carpet tack with the point toward the bark, and it is usually accompanied by discoloration extending for a considerable distance along the grain and to a much lesser extent across the grain. The discoloration produced by bird peck causes what is commonly known as mineral streak.

Boxed Heart. The term used when the pith falls entirely within the four faces of a piece of wood anywhere in its length. Also called boxed pith.

Check. A lengthwise separation of the wood that usually extends across the rings of annual growth and commonly results from stresses set up in wood during seasoning. Checks are measured as an average of the penetration perpendicular to the wide face. Where two or more checks appear on the same face, only the deepest one is measured. Where two checks are directly opposite each other, the sum of their depths is used.

Contiguous Checks. Individual checks that are adjoining though not in contact with adjacent checks.

Crook or Sweep. A distortion of a piece of lumber or post in which there is a deviation in a direction perpendicular to the edge from a straight line from end to end of the piece.

Decay. The decomposition of wood substance caused by action of wood destroying fungi, resulting in softening, loss of strength and weight and often in change of texture and color.

Advanced (or typical) Decay. The older stage of decay in which the destruction is readily recognized because the wood has become punky, soft and spongy, stringy, ring-shaked, pitted, or crumbly. Decided discoloration or bleaching of the rotted wood is often apparent.

Incipient Decay. The early stage of decay that has not proceeded far enough to soften or otherwise perceptibly impair the hardness of the wood. It is usually accompanied by a slight discoloration or bleaching of the wood.

Defect. Any irregularity or imperfection occurring in or on the wood that may lower its durability or strength.

Grain. The direction, size, arrangement, appearance, or quality of the fibers in wood or lumber.

Heartwood. The wood extending from the pith to the sapwood, the cells of which no longer participate in the life processes of the tree. Heartwood may be infiltrated with gums, resins, and other materials that usually make it darker and more decay resistant than sapwood.

Knot. That portion of a branch or limb which has been surrounded by subsequent growth of the wood of the trunk or other portion of the tree. As a knot appears on the sawed surface it is merely a section of the entire knot, its shape depending upon the direction of the cut. Knot diameter is measured as shown. The least dimension is used to determine size of the knot.

Knot Cluster. Three or more knots in a compact, roughly circular group, with the grain between them highly contorted. Two or more knots laterally arranged and without contortion of the fibers between them do not constitute a knot cluster.

Loose Knot. A knot that is not held firmly in place by growth or position and that cannot be relied upon to remain in place.

Sound Knot. A knot that is solid across its face, at least as hard as the surrounding wood, and shows no indication of decay.

Unsound Knot. A knot that, due to decay, is softer than the surrounding wood.

Mineral Streak. An olive to greenish-black or brown discoloration of undetermined cause in hardwoods, particularly hard maples; commonly associated with bird pecks and other injuries; occurs in streaks usually containing accumulations of mineral matter.

Peeling (clean). The removal of all outer bark and at least 80 percent of the inner bark distributed over the surface of the post, pile, or block.

Pith. The small, soft core occurring in the structural center of a tree trunk, branch, twig, or log.

Plugged Hole. Any opening, or defect, which has been filled, or repaired, through the use of wooden plugs, plastic wood, or other methods. Holes resulting from the taking of test cores by an increment borer to check penetration or retention of preservative and filled with tight-fitting pressure treated plugs are not to be considered as plugged holes for rejection purposes.

Sapwood. The living wood of pale color near the outside of the log. Under most conditions the sapwood is more susceptible to decay than heartwood.

Shake. A separation along the grain, the greater part of which occurs between the rings of annual growth. Shakes are measured at the ends of pieces between lines parallel with the two faces that give the least dimension.

Slope of Grain. Slope of grain is the deviation of the wood fiber from a line parallel to the edges of a piece. The deviation is expressed as a ratio such as a slope of grain of 1 in 8, etc. Generally, slope of grain shall be measured over sufficient length and area to be representative of the general slope of the fibers, disregarding local variations.

Split. A lengthwise separation of the wood extending through the piece from one surface to an opposite or to an adjoining surface, due to the tearing apart of wood cells. Splits are measured as the penetration of a split from the end of the piece and parallel to edges of the piece.

Twist. A distortion caused by the turning or winding of the edges of a board so that the four corners of any face are no longer in the same plane.

Unsightly Gaps. The term as used in these specifications is interpreted as being any gap, or opening, which is more than ⅜ inch at its maximum width and more than 12 inches in length.

Wane. Bark, or lack of wood from any cause, on edge or corner of piece.

For definitions of additional terms relating to wood and wood preservation refer to: ASTM D 9, *Standard Terminology Relating to Wood,* and AWPA Standard M 5, *Glossary of Terms Used in Wood Preservation.*

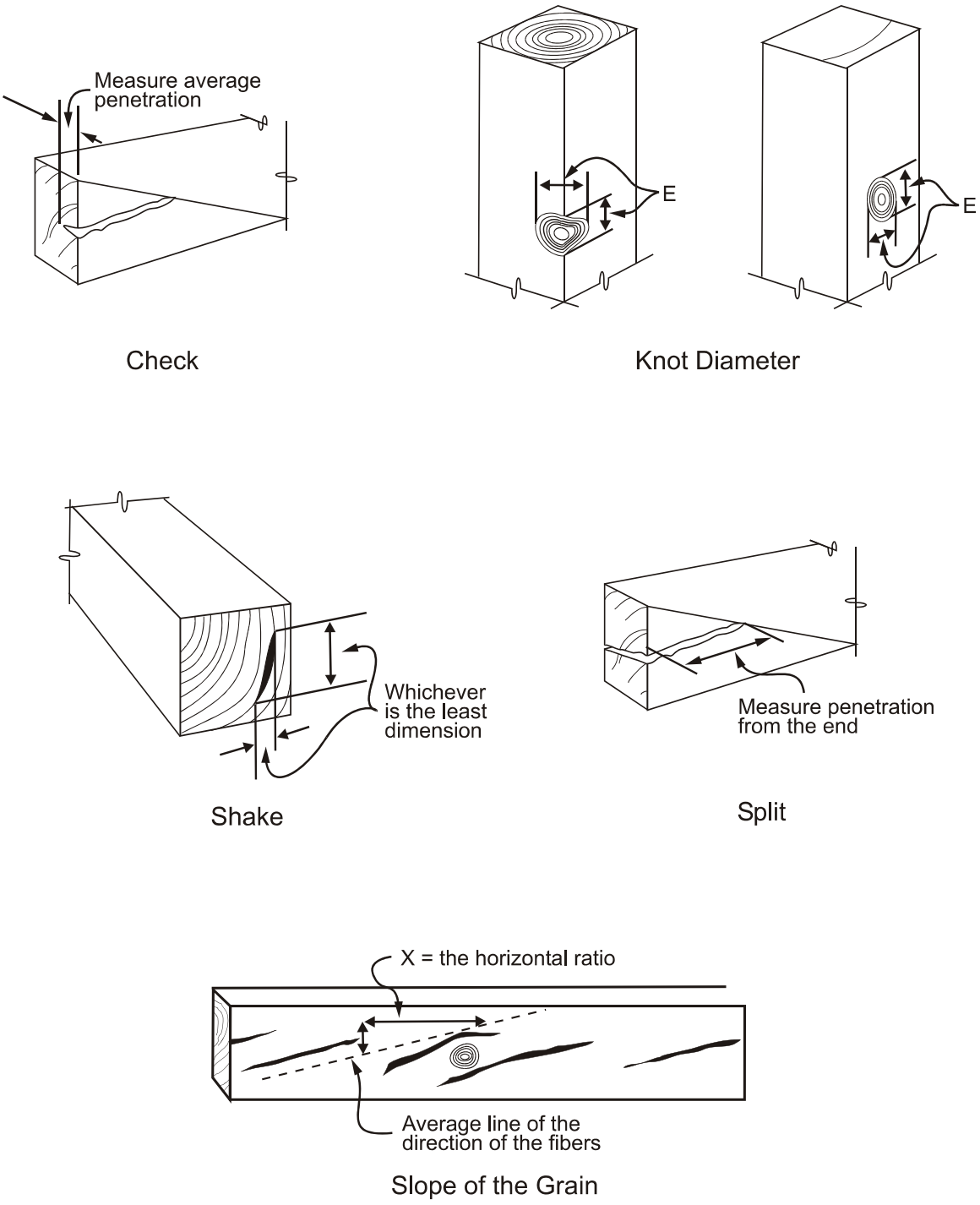

Figure 912-1 Timber and Lumber Terminology

912.06 Structural Timber and Lumber.

A. **Grade.** Structural timber and lumber shall be the grade required by the plans or otherwise specified and shall be graded according to the grading and dressing rules in ASTM D 245.

B. **Species.** The use of species not specifically included in ASTM D 1760 shall require prior Department approval and shall be treated according to the requirements for red oak.

C. **Preservative Treatment.** Conditioning and preservative treatment shall be performed according to ASTM D 1760, Table 1, Ground Contact.

D. **Preservatives.** The chemical preservative used shall be listed in ASTM D 1760 and associated AWPA Standards.

912.07 Timber Piles.

A. **Physical Characteristics and Species.** Timber piles, prior to preservative treatment, shall meet the requirements of ASTM D 25, Standard Specification for Round Timber Piles, except as modified in this specification. The species shall be douglas-fir, western larch, southern pine, cypress, red pine, eastern white pine (northern white pine), tamarack, or red oak.

B. **Dimensions.** The circumference of piles measured under the bark shall have minimum and maximum values as shown in Table 912-1, except that 10 percent of the piles in any shipment lot may have circumferences 2 inches less than the tabulated minimum values. The ratio of the maximum to minimum diameter at the butt of any pile shall not exceed 1:2.

Table 912-1 Circumferences and Diameters of Timber Piles

Length, Feet	3 Feet from Butt				At Tip	
	Minimum		Maximum		Minimum	
	Circumference in.	Diameter approx. in	Circumference in	Diameter approx. in	Circumference in	Diameter approx. in
Douglas Fir, Larch, Pine, or Tamarack						
Under 40	38	12	63	20	25	8
40 to 50 incl.	38	12	63	20	22	7
Over 50 to 70 incl.	41	13	63	20	22	7
Over 70 to 90 incl.	41	13	63	20	19	6
Over 90	Dimensions shall be as specified in the proposal or on the plans					
Oak and Cypress						
Under 30	38	12	57	18	25	8
30 to 40 incl.	41	13	63	20	22	7
Over 40	41	13	63	20	19	6

C. **Sapwood.** All piles shall have sapwood of a minimum thickness of one inch at the butt end.

D. **Straightness.** A line drawn from the center of the butt to the center of the tip shall lie wholly within the body of the pile. Piles shall have a uniform taper from butt to top and shall be free from short crooks.

E. **Knots.** Piles shall be free from unsound and loose knots. Sound knots are permitted not exceeding 4 inches in diameter or one-third of the least diameter or dimension of the pile at the point where they occur, except that in piles for use as structural members in exposed work, sound knots of a diameter exceeding one-quarter of the least diameter or dimension of the pile at the point where they occur, are not permitted.

F. **Checks.** Checks wider than ¼ inch or deeper than 2 inches are not permitted.

G. **Peeling (Shaving).** All piles shall meet the requirements for clean-peeled piles.

H. **Preservative Treatment.** Conditioning and preservative treatment of timber piles shall be according to ASTM D 1760, Table 2.

912.08 Posts.

A. **General.** Posts shall have been cut from live timber and shall be free from bird pecks and insect holes. All posts shall be sawn square at both ends.

B. **Species and Grades.** Posts used for fence posts, guide posts, guard posts, and mailbox posts shall be manufactured from the species listed in Table 912-2.

Table 912-2 Species and Grading Requirements for Posts

Species	Round Posts Grade	Sawn Posts Agency (a)
Hardwoods	ASTM D 245	MDOT
Red Oak (Northern Red, Black, Pin Laurel, Cherry-Bark, Scarlet, Water, and Willow Oaks) (b)		
Hard Maple (Black & Sugar) and Red Maple		
White Ash		
White-Heartwood Beech		
Yellow Birch		
Softwoods		
Northern White Cedar	No. 1 or better	NHPMA
Red Pine, and Eastern White Pine (Northern White Pine)	No. 2 or better	WCLIB, WWPA
Douglas-fir	No. 2 or better	SPIB
Southern Pine Species		

a. NHPMA (Northern Hardwood and Pine Manufacturers Assoc.); WWPA (Western Wood Products Assoc.); WCLIB (West Coast Lumber Inspection Bureau); and SPIB (Southern Pine Inspection Bureau)
b. Southern Red Oak is not permitted.

C. **Marking.** Posts, as applicable, shall show the approved grading agency stamp indicating mill origin, species, and grade.

D. **Dimensions.** Line posts shall be 7 feet long and shall have either a nominal 4-inch square cross section or a round cross section having a minimum diameter of 4½ inches.

End, corner, gate, intersection and intermediate braced posts shall be 8 feet long and have either a nominal 6-inch square cross section or a round cross section having a minimum diameter of 8 inches.

Mailbox posts shall be 6 feet long and shall have either a nominal 4-inch square cross section or a round cross section having a minimum diameter of 4-½ inches .

E. **Dimensional Tolerances.** The measured top diameter of all round posts shall be within a tolerance of + ¾ inches and -¼ inches of the specified diameter. The size of a post not perfectly round shall be determined by its average top diameter. The measured length shall be equal to the nominal length ±2 inches.

F. **Decay.** Butt rot in excess of 5 percent of the area of the butt is not permitted. Tops of all posts shall be sound, except that one pipe rot not to exceed ⅜ inch in diameter is permitted in posts 6 inches or more, nominal top size.

G. **Knots.** Sound knots are permitted providing they do not significantly impair the strength of the post and are trimmed flush with the surface of the post.

H. **Crook or Bow.** Short crooks, one way sweep exceeding 2 inches, and winding twists that are unsightly and exaggerated are not permitted.

I. **Surface.** Fence posts shall be peeled their entire length or shaved to remove all outer bark. Shaving to remove all inner bark is not required.

Round posts for mailbox posts, guard posts, and guide posts shall have the inner and outer bark completely removed.

J. **Preservative Treatment.** All round posts, except northern white cedar, shall be conditioned and treated with a preservative according to AWPA Standards C 5 and ASTM Standard D 1760. Sawn posts shall be treated according to AWPA Standards C 1 and C 2 and ASTM D 1760.

K. **Conditioning.** When air seasoning is utilized, posts shall be stacked in a manner approved by the Department until the average moisture content does not exceed 19 percent.

L. **Preservatives.** The preservative used for treating posts shall conform to the following AWPA Standards:

Material	**AWPA Standard**
pentachlorophenol in Type A hydrocarbon solvent	P8, P9
chromated copper arsenate (CCA)	P5
ammoniacal copper arsenate (ACA)	P5
ammoniacal copper zinc arsenate (ACZA)	P5

M. **Results of Treatment.** The minimum preservative penetration and retention are shown in Table 912-3 when determined according to AWPA Standards.

Table 912-3 Treatment Results Requirements

Preservative	Minimum Retention 0.0 in - 0.6 in zone	AWPA Standard
Pentachlorophenol Type A CCA, ACA, ACZA	0.60 pcf 0.60 pcf	A 5 A 11
Minimum Penetration		
Species	Heartwood	Sapwood
Hardwoods & Douglas-fir	0.3 in. min.	0.6 in. or 90% whichever is greater
Softwoods		2.0 in. or 90% whichever is greater

912.09 Sawn Timber Posts and Blocks for Beam Guardrail and Highway Signs.

A. **Species and Grades.** Wood posts for guardrail shall be of the species listed, and shall meet the grading requirements in Table 912-4. Wood blocks shall be the species listed, and shall meet the grading requirements in Table 912-5. Species permitted and grades required for sign posts, shall be as specified in Table 912-6. The approved stamp shall be applied to the middle one-third of each sign post on the wider face.

Wood posts and blocks for guardrails shall have a nominal 6 by 8 inch cross section, except that jack pine for posts, furnished in No. 1 Grade or better shall have a nominal 8 by 8 inch cross section. Sawed wood posts for signs shall have a nominal 4 by 6 inch or 6 by 8 inch cross section.

Table 912-4 Species and Grading Requirements for Sawn Timber Guardrail Posts

Species	Posts & Timbers Grade	Grading Rules Agency (a)
Hardwoods	Grade GRP	MDOT
Red Oak (Northern Red, Black, Pin, Laurel, Cherry-Bark, Scarlet, Water, and Willow Oaks) (b) Hard Maple (Black & Sugar) and Red Maple White Ash White-Heartwood Beech Yellow Birch Hickory (Mockernut, Pignut, Shagbark, and Shellbark Hickories)		
Softwoods	No. 1 or better	WWPA or WCLIB
Douglas-fir, Douglas-fir/Larch		
Southern Pine	No. 1 or better	SPIB
Jack Pine 8 in. x 8 in.	No. 1 or better	NHPMA

a. NHPMA (Northern Hardwood and Pine Manufacturers Assoc.); WWPA (Western Wood Products Assoc); WCLIB (West Coast Lumber Inspection Bureau); and SPIB (Southern Pine Inspection Bureau).
b. Southern Red Oak is not permitted.

1. **MDOT Grade GRP.** The requirements for posts to meet MDOT Grade GRP (Guardrail Posts) are as follows:

a. **Splits.** Splits in the plane of the bolt hole shall not exceed 3 inches. At other locations, splits shall not exceed 6 inches.

b. **Checks.** Single checks shall not be greater than 3 inches deep and checks opposite each other shall not total more than 3 inches deep, as measured with a probe that is not more than $^{1}/_{16}$ inch in thickness or in diameter.

Single checks ¼ inch wide, or wider, measured at the widest point, shall not extend more than one-third of the length of the post.

Single checks, measured at the widest point, shall not exceed ⅜ inch in width.

c. **Shakes.** Shakes, measured in the least dimension, shall not exceed 2 inches.

d. **Splits, Checks, and Shakes.** Splits, checks, and shakes shall not be in combinations which could cause the post to separate into several pieces.

e. **Stains.** Stained heartwood (not caused by decay) shall not exceed 25 percent of the piece.

f. **Slope of Grain.** Slope of grain shall not exceed 1:10.

g. **Wane.** Wane shall be less than ¼ of any face.

h. **Knots.** Knots shall be sound and tight. The sum of the least dimensions of all knots in any 6-inch length of post (all faces) shall be less than 5 inches. Grain distortion caused by knot clusters shall not exceed 2-½ inches. Knots are permitted on all faces but knots shall not exceed 2-½ inches in the least dimension.

2. **MDOT Grade GRB.** The requirements for blocks to meet MDOT Grade GRB (guardrail blocks) are as follows:

a. **Splits.** Splits in the plane of the bolt hole shall not exceed 3 inches. At other locations, splits shall not exceed 5 inches.

b. **Checks.** Single checks shall not be greater than 3 inches deep and checks opposite each other shall not total more than 3 inches deep, as measured with a probe that is not more than $^{1}/_{16}$ inch in thickness or in diameter.

Single checks ¼ inch wide, or wider, measured at the widest point, shall not extend more than one-third of the length of the block.

Single checks, measured at the widest point, shall not exceed ⅜ inch in width.

c. **Shakes.** Shakes, measured in the least dimension, shall not exceed 3 inches and shall not extend beyond half the standard grading length of the piece.

d. **Splits, Checks, and Shakes.** Splits, checks, and shakes shall not be in combinations which would cause the block to separate into several pieces.

e. **Stains.** Stained heartwood, not caused by decay, shall not exceed 25 percent of the piece.

f. **Wane.** Wane shall be less than one-third of any face.

g. **Knots.** Grain distortion caused by knot clusters shall not exceed 4 inches. Knots are permitted on all faces but knots shall not exceed 4 inches in the least dimension.

Table 912-5 Species and Grading Requirements for Sawn Timber Guardrail Blocks

Species	Blocks Grade	Grading Rules Agency (a)
Hardwoods	Grade GRB	MDOT
Red Oak (Northern Red, Black, Pin, Laurel, Cherry-Bark, Scarlet, Water, and Willow Oaks) (b) Hard Maple (Black & Sugar) and Red Maple White Ash White-Heartwood Beech Yellow Birch Hickory (Mockernut, Pignut, Shagback, and Shellbark Hickories)		
Softwoods	No. 2 or better	WCLIB, WWPA
Douglas-fir and Douglas-fir/Larch		
Southern Pine Species	No. 2 or better	SPIB
Jack Pine, Red Pine, and Eastern White Pine (Northern White Pine)	No. 1 or better	NHPMA

a. NHPMA (Northern Hardwood and Pine Manufacturers Assoc.); WWPA (Western Wood Products Assoc); WCLIB (West Coast Lumber Inspection Bureau); and SPIB (Southern Pine Inspection Bureau).
b. Southern Red Oak is not permitted.

Table 912-6 Species and Grading Requirements for Sawed Sign Posts

Species	Grade	Grading Rules Agency (a)
4 in. by 6 in. (nominal) Posts		
Balsam Fir	No. 1 (Joists-Planks)	NELMA
Douglas Fir	No. 1 (Joists-Planks)	WCLIB
Eastern Hemlock	No. 1 (Joists-Planks)	NHPMA
Tamarack(Eastern Larch)	No. 1 (Joists-Planks)	NHPMA
Eastern White Pine	Select Structural (Joists-Planks)	NELMA
Southern Pine	No. 1 (Joists-Planks)	SPIB
6 in. by 8 in. (nominal) Posts		
Douglas Fir	No. 1 Dense (Posts-Timbers)	WWPA
Southern Pine	No. 1 SR (Stress Rated Timbers)	SPIB
Eastern Hemlock	Select Structural (Posts-Timbers)	NELMA
Tamarack(Eastern Larch)	Select Structural (Posts-Timbers)	NELMA

a. NHPMA (Northern Hardwood and Pine Manufacturers Assoc.); WWPA (Western Wood Products Assoc); WCLIB (West Coast Lumber Inspection Bureau); and SPIB (Southern Pine Inspection Bureau).

B. **General Requirements.** Posts and blocks shall meet the following general requirements:

1. **Decay.** Posts and blocks shall be free from decay before treatment.

2. **Crook or Bow.** Crook or bow shall not exceed 1 inch per 10 foot length. (Example: 0.7 inch in 7 feet, 0.8 inch in 8 feet, etc.)

3. **Dimensional Tolerances.** Posts and blocks shall be sawn square to within -½ inch of the specified cross-sectional dimensions. A tolerance of -2 inches will be permitted on the specific length of the posts. A tolerance of -½ inch will be permitted on the specified length of the blocks.

C. **Incising.** All posts shall be incised before treatment. Blocks are not required to be incised. The incisor shall have teeth of nominal ⅞ inch length to make cuts spaced at 2½ inches lengthwise of the piece, in rows ¾ inch apart, with alternate rows staggered by 1¼ inches to form diamond patterns of incisions (diamonds being 2½ inches long and 1½ inches wide center to center of incision marks), approximately 60 per square foot. Southern pine may be incised with ¾ inch teeth.

Incising posts according to Article 3.6.2 of the AREA *Manual for Railway Engineering* is an approved alternate method.

D. **Inspection Before Treatment.** Material that has been air dried or kiln dried shall be inspected for moisture content as specified in subsection 912.09.E, according to AWPA Standard M2. Tests of representative pieces shall be conducted. The minimum number of tests shall be the lesser of 5 percent or 50 pieces out of a charge.

E. **Test for Moisture Content.** The test shall be made with an electrical resistance type moisture meter with insulated needles of 1½ inches in length. The readings shall be corrected for species and temperature readings per meter instructions, and shall be taken on one surface at mid-length with needles driven to their full length. The lot shall be considered acceptable when the average moisture content does not exceed 19 percent. Any individual pieces exceeding 23 percent moisture content will be rejected and shall be removed from the lot.

F. **Preservative Treatment.** Wood for guardrail posts and blocks shall be treated according to AWPA Standards C1 and C2, ASTM D 1760, and the requirements specified here. Wood for sign posts shall be treated according to the above plus AWPA C14.

G. **Preservatives.** The preservative used for treating posts and blocks shall conform to subsection 912.08.L

H. **Sorting and Spacing.** The material in any charge shall consist of the same species or consist of species within any one group shown in Table 912-7. The material shall have similar moisture content and be of similar form and size.

Blocks and posts can be treated in the same charge following the retention requirements of subsection 912.09.K. Pieces in the charge shall be separated by horizontal spacers so that preservative and steam (if used) will contact all horizontal surfaces.

Table 912-7 Species Groupings for Treatment in Same Charge Group

Group	Species
A	Southern Pine
B	Douglas-Fir, Balsam Fir, Eastern Hemlock, Tamateck
C	Jack Pine, Red Pine and Eastern White Pine
D	Hardwoods

I. **Conditioning.** Material may be conditioned by air seasoning, kiln drying, Boulton drying, vapor drying, steaming, and heating in preservative.

Material that is air seasoned or kiln dried shall have an average moisture content not exceeding 19 percent before treatment.

When steam conditioning, the maximum temperature indicated in Table 912-8 shall not be reached in less than one hour. If a vacuum is applied after steaming, it shall be a minimum of 22 inches of mercury. In addition, when using CCA, ACA or ACZA, material must be removed from the cylinder and allowed to cool to 120 °F, or below, after steaming and before the preservative is applied. When treating douglas-fir with pentachlorophenol, steaming will not be permitted. When treating southern pine, jack pine, and red pine with CCA, ACA or ACZA, steaming will only be permitted to thaw frozen or ice coated material. When conditioning by heating in preservative, the solution shall cover the material. Maximum temperatures permitted are given in Table 912-8. Conditioning by heating in water-borne preservatives (CCA, ACA or ACZA) will not be permitted.

Table 912-8 Conditioning Methods and Temperature Requirements for Method Used

Species	Conditioning Methods Permitted	Steaming		Heating in Preservative	
		Max. Temp. ^{0}F	Max. Duration hours	Max. Temp. ^{0}F	Max. Duration hours
Hard Maple	Air drying only No steaming	—	—	—	—
Other Hardwoods (a)	See I. Conditioning	---	---	220	No limit
Southern Pine	See I. Conditioning	245	17	220	No limit
Eastern White Pine	See I. Conditioning	240	4-1/2	210	6 (c)
Other Softwoods (b)	See I. Conditioning	240	6	210	6 (c)

a. Red Oak, White Ash, White-Heartwood Beech, Yellow Birch, Hickory, and Red Maple.
b. Jack Pine, Douglas Fir, and Red Pine, Balsam Fir, Eastern Hemlock, Tamarack.
c. If seasoned material is used, otherwise no limit.

J. **Treatment.** Treatment shall achieve the retentions specified in subsection 912.09.K and the penetrations in subsection 912.09.L.

Pressure shall be increased to at least the minimum but not higher than the maximum levels given in Table 912-9 and shall be maintained until the desired volume of preservative has entered the wood.

The temperature of the preservative during the entire pressure period shall not exceed the following maximum temperatures:

pentachlorophenol in Type A hydrocarbon solvent . . . . . 210 °F
ammoniacal copper arsenate (ACA) . . . . . 150 °F
chromated copper arsenate (CCA) . . . . . 120 °F
ammoniacal copper zinc arsenate (ACZA) . . . . . 150 °F

When treating with pentachlorophenol, an expansion bath or a final steaming may be applied to the indicated species after completion of the pressure phase of the treatment, as specified in Table 912-9.

Table 912-9 Pressure Requirements by Species

Species	Pressure		Where Preservative is Penetachlorophenol in Type A Hydrocarbon Solvent		
			Expansion Bath	Final Steaming (a)	
	Min. (psi)	Max. (psi)	Max. Temp., ^{0}F	Max. Temp., ^{0}F	Max. Duration, hours
Red Oak	125	250	Not Permitted	240	1
Other Hardwoods	125	200	Not Permitted	240	1
Jack Pine, Red Pine	75	175	220	240	2
Southern Pine	75	200	220	240	2
Douglas Fir, Balsam Fir, Eastern Hemlock, Tamarack	50	150	220	240	2
Eastern White Pine	50	135	220	240	1

a. If seasoned material is used, post-steaming at 225°F for a maximum period of 15 hours will be permitted.

K. **Retention.** The minimum retention in pounds per cubic foot for the outer 0.6 inches of guardrail posts, blocks, and sign posts, are listed in Table 912-10. Retention shall be determined by chemical assay with samples taken after treatment according to subsection 912.09.M, and following AWPA standards listed in Table 912-10. If blocks are treated along with posts, retention of the charge shall be determined by assay of borings from posts.

Table 912-10 Minimum Retention Requirements

Preservative	Minimum Retention, (pcf)			AWPA Standard
	Guardrail Posts	Sign Posts	Blocks	
Pentachlorophenol	0.60	0.50	0.40	A5
CCA, ACA, or ACZA	0.60	0.50	0.40	A11

L. **Penetration.** The penetration requirements for heartwood and sapwood shall be as specified in Table 912-11. Samples to determine penetration shall be taken after treatment according to subsection 912.09.M.

Table 912-11 Penetration Requirements-Posts and Blocks

All Permitted Species (a)	Minimum Penetration	
	Heartwood	Sapwood
Guardrail Posts and Blocks	0.3 in.	0.6 in. or 90 percent, whichever is greater
Sign Posts	0.5 in.	

a. For Red Oak, 65 percent of the total annual rings shall be penetrated; however, if this is not possible, properly conditioned wood may be treated to refusal.

M. **Inspection After Treatment.** Following treatment, the charge shall be examined by the treater for cleanliness, mechanical damage to individual pieces, treatment damage such as severe checking, splitting, or honeycombing, and for any untreated areas resulting from air pockets, floating material, or insufficient height of preservative. Any such material shall be removed from the remaining acceptable material before shipment.

Sampling and testing for preservative retention and penetration will be done by the Department. Sampling will be done according to MTM 713.

N. **Branding.** All posts and blocks shall be burn branded clearly and permanently on one of the wide faces; on guardrail posts, the brand shall be within one foot of the top of the post and on sign posts the brand shall be within the middle one-third of the post. The brand shall show: the treater ID, the plant designation, the year of treatment (the month may be included), the species (or group code designation shown in Table 912-12), and the preservative type, and retention, all according to AWPA standard M 6.

Table 912-12 Group Coding as an Alternate to Species Coding

Group	Code (a)
Hardwoods	MH
Jack Pine	J
Other Softwoods	MS
Southern Pine	SP
Douglas Fir	DF

a. Species designated in Tables 912-4, 912-5, and 912-6.

O. **Conformance.** The treating plant supplying the material shall be responsible for, and will be required to supply a certificate indicating the species, grade, preservative type, retention, year, and name of treater.

P. **Degrade After Treatment.** Guardrail posts or blocks developing the following degrade prior to installation will be rejected regardless of any prior approvals:

1. Single checks greater than 3 inches deep or checks opposite each other totaling more than 3 inches deep, measured with a probe not more than $^{1}/_{16}$ inch thick,

2. Single checks ¼ inch wide or wider measured at the widest point, and extending more than one-third of the length of the post or block,

3. Single checks greater than ⅜ inch wide measured at the widest point,

4. Splits greater than 3 inches long which are in the plane of the bolt hole,

5. Crooks or bows exceeding 1inch per 10 foot length, and any twists,

6. Combinations of checks, splits, or shakes which otherwise meet specifications but which could cause the post or block to separate into several pieces.

912.10 Timber for Rustic Construction.

A. **Species and Grade.** Logs, posts, timbers, and split rails designated for rustic construction shall be of sound unfinished eastern white pine (northern white pine), red pine, ponderosa pine, douglas-fir, northern white cedar, southern pine. All material shall be free from decay and shall have the bark removed. Salvaged rails shall be obtained from existing rail fences and shall be reasonably sound and uniform in straightness and size.

B. **Shape and Dimensions.** All materials shall be of uniform straightness, except where curved or angular logs are indicated on the plans, and shall be of the dimensions specified. Logs and posts shall have an average diameter at the small end of not less than the specified diameter minus ¼ inch.

C. **Preservative Treatment.** Wood, other than northern white cedar, used in rustic construction shall be conditioned and pressure treated according to ASTM D1760, Table 1, Ground Contact.

D. **Preservatives.** The preservative used for treating material for rustic construction shall conform to subsection 912.08.L.

E. **Results of Treatment.** Results of treatment, including preservative analysis and penetration and retention determinations shall be performed according to ASTM D1760 and associated AWPA standards.